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THE

ARTISTIC ANATOMY

OF

THE HORSE.

BY

B. WATERHOUSE HAWKINS, F.L.S. F.G.S.

AUTHOR OF

"POPULAR COMPARATIVE ANATOMY," "ELEMENTS OF FORM," "COMPARATIVE VIEW OF THE HUMAN AND ANIMAL FRAME," AND RESTORER OF THE EXTERNAL FORMS OF THE EXTINCT ANIMALS AT THE CRYSTAL PALACE PARK, SYDENHAM.

With Twenty-four Illustrations on Wood by the Author.

FIFTH EDITION.

Ars probat artificem.

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THE

ARTISTIC ANATOMY

OF

THE HORSE.

BEFORE proceeding to the Anatomy of the Horse, it may be desirable to glance at some of the varieties of form which have been represented in the works of the earlier masters, either of painting or sculpture; and to observe how far they may be of value for imitation by the art-student of the present day. Such varieties are not very numerous, and those most frequently introduced present distinctions often peculiar to the times in which they were painted.

The external characteristics of the horse are strongly marked, and, as will be shown hereafter, are, to a large extent, due to the proportions and prominence of particular parts of the bony frame or skeleton. Constant, however, as are these general characters, the figure of the horse is as varied as the purposes for which man employs him, and to which in obedience to the demands of fashion, and the requirements of industry or

sport, a careful attention to scientific breeding has been able to adapt it. Although such variations in external form are particularly marked at the present day, when the horse is so universally employed, and when, as a rule, each description of work is performed by an animal having qualities especially adapted for it, such was not the case in earlier times. Horses were then chiefly required for warlike purposes, and there was little need of any great diversity in their form or character.

In early historic times the horse was rarely, if ever, used for agricultural purposes. Oxen were then, as in many countries, they are now, the only animals employed for draught in the laborious operations of husbandry. In the East and in the warmer parts of Europe, the horse was generally of a lighter and smaller type than those in the West and North. It was well-fitted by its activity for the purposes of light draught and was in constant use in the chariot—speed and good action being among the most essential qualities of the horses thus employed.

We find examples of them in the Nineveh Sculptures, which give such evidently faithful representations of the light and graceful horses then in use, that we need only copy them with care to ensure entire accuracy. The Greeks have also left us complete fac-similes of the horses of their time. The sculptures known as the "Elgin Marbles" in the British Museum are perfect studies from nature, and from these the art-student or amateur, after he has acquired a thorough knowledge of

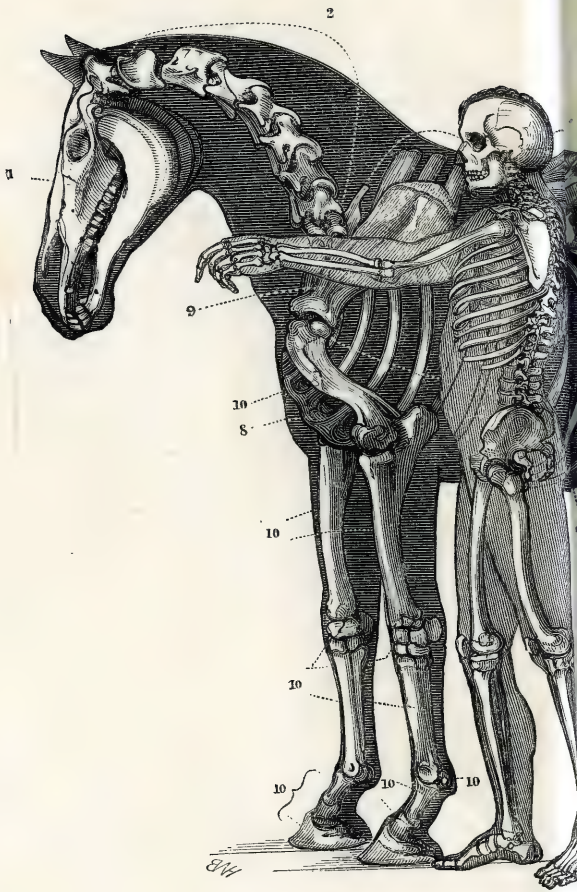
the skeleton, may obtain all that can be learned of the general side view of the horse.

If we turn now to the works of the great masters of the sixteenth and seventeenth centuries we find a particular type of horse generally represented. This is what, not very long ago, artists delighted in calling the "historical" horse—a large-boned, heavy animal in appearance, intermediate between a dray-horse and a carriage-horse, such as we see in the pictures of Velasquez, Rubens, Vandyke, Wouvermans and others. These were the horses of the period—the great Flemish and the Norman horses, whose bone and substance were essential to the fashion of the times which required them as chargers to carry into battle a weight of armour, accoutrements, and weapons of the heaviest description, or its mimic-field, the tournament, to move with slow and stately pace under the massive trappings of their knightly riders. The horse in the well-known equestrian statue of Charles I. at Charing Cross is deservedly regarded as an excellent representation of the once famous breed of Flemish horses, now, however, replaced by others more suited to the requirements of modern warfare.

The light dragoon with his small active horse must, however, be considered as quite a recent feature in what are now commonly spoken of as battle pieces. The typical Norman horse may still be seen on the Continent, in the few places where that almost extinct conveyance, the *diligence* drags on a lingering existence; and the great Flemish horse with his high bones, mas-

sive muscles and flowing mane still holds his place in his native country. But it must not be forgotten that these animals so commonly represented in the old paintings belonged to a national type, which, in course of time, and in accordance with the prevailing fashion, gradually extended into other lands. It became the model in various schools of art because it was the particular breed in general use, and was familiar to the people in such scenes as painters loved to represent. It need hardly be mentioned, however, that this historical horse can rarely have a place in the works of modern artists, particularly those of the English school. Fresh breeds have been introduced, and English types now furnish the student or amateur with abundant models of the forms best suited to the varied subjects of his pencil.

For a due comprehension of the shape and action of the horse, it is essential that the art-student should possess a thorough acquaintance with the arrangement and position of the bones, and their relation to one another. The osseous framework or skeleton must therefore be attentively studied as the only foundation upon which can be based any hope of power to represent the horse, either by drawing, painting, or modelling. The importance of this first step cannot be too strongly insisted upon, for without a knowledge of the bones, the precise situation of the muscles cannot be determined, or their action on their limbs properly understood. Having mastered the details of the skeleton, the muscles will then demand attention : and when once a general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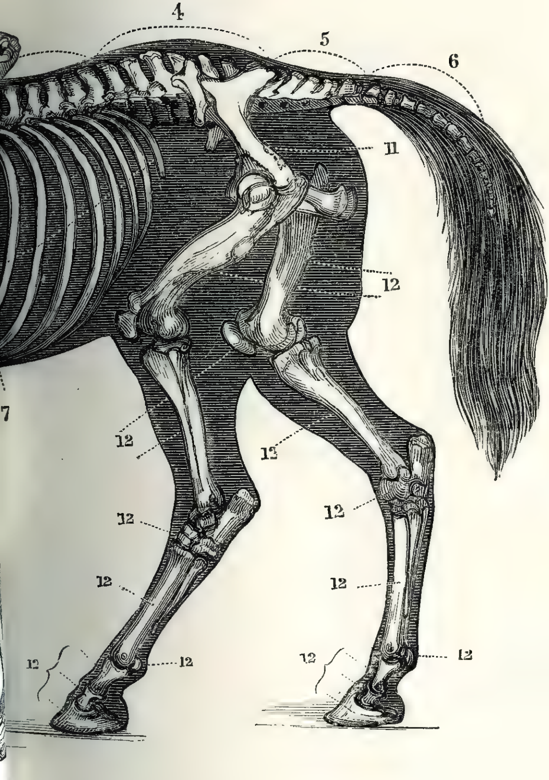
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knowledge of them has been acquired, the eye accustomed to habits of accurate observation will readily discern in the living horse, the true appearance of those parts of the muscular system which are most prominently brought into view, and on whose alteration of form, when called into action, the minute but important changes of outline in the various parts of the animal principally depend.

PLATE II.

THE SKELETON OF THE HORSE.

1. Cranium. See Plate IV.
2. Cervical vertebræ. See Plate IV.
3. Dorsal vertebræ.
4. Lumbar vertebræ.
5. Sacral vertebræ.
6. Caudal vertebræ.
7. Ribs.
8. Sternum.
9. Scapula. See Plate X.
10. Front limbs. See Plate VII.
11. Pelvis. See Plate XII.
12. Hind limbs.

THE SKELETON.

The series of bones comprised in the skeleton may be

conveniently divided into two groups, the first comprehending the head, neck and backbone with the ribs, sternum and haunch bones—in other words, the vertebral column and all those bones which are in immediate connection with it, together constituting the frame-work of the trunk, the second group comprising the bones of the limbs or legs, divided into a double series of somewhat complicated articulations or joints, necessary for the safety of the animal under the manifold shocks and strains to which its varied and often violent action continually exposes it.

In Plate II. is given a view of the entire skeleton of the horse, showing the various bones in their natural position and relation to one another. The head may, for descriptive purposes, be divided into two parts—the skull and the face ; each having its own particular bones, whose relative size varies in some slight degree in the different breeds, and considerably affects the intelligent expression more or less to be observed in the face of every horse. These bones will be more particularly described in the chapter on the bones of the head and neck.

The bones composing the vertebral column are divided into five groups.

The *cervical* vertebræ (Pl. II, 2. Pl. IV, fig. 2), or those of the neck, extending from the head to the ribs, are seven in number in the horse, as in all other mammalia. Eighteen are given to the back, and are called *dorsal* (Pl. II, 3) ; these are the only ones bearing the ribs. The third group contains six vertebræ, the *lumbar* (Pl.

II, 4), or those of the loins, situated between those bearing the ribs and the haunch bones. It should be borne in mind, however, that the number of ribs is sometimes found to exceed that stated above; nineteen, and, occasionally, twenty ribs are found in the horse; but in such cases there is no actual increase in the number of bones in the vertebral column. The *dorsal* and *lumbar* vertebræ together are always twenty-four, so that if one or two ribs above the normal number are present, thereby increasing the contents of the *dorsal* series, the *lumbar* vertebræ are proportionately reduced. The fourth (Pl. II, 5), the *sacral*, includes five bones which are anchylosed or united together into one mass, and, thus joined act as a kind of wedge or keystone to the arch formed by the approximation, at this point, of the haunch bones. Great strength and solidity are required here, as the united bones of the haunch, or *pelvic arch*, as they are called by anatomists, are the great pivots on which the hinder limbs turn, and by which they are enabled to throw forward the whole weight of the animal. The remaining vertebræ are those of the *caudal* (Pl. II, 6), usually fifteen; they are, however, exceedingly subject to variations to the extent of two or three above or below the number above mentioned.

To recapitulate, the normal contents of each series of vertebræ will stand thus :—

Cervical, 7; Dorsal, 18; Lumbar, 6; Sacral, 5; Caudal, 15; total, 51.

The form of these bones varies considerably in the dif-

ferent parts of the vertebral column. It will be unnecessary, however, to describe them very minutely, as, except in the case of those of the back, their shape does not conspicuously affect that of the animal. The most prominent feature in each dorsal vertebra is the strong *spinous* process or projection on its upper surface. These processes are largely developed on the anterior portion of the dorsal series, and produce the elevation or prominence above the shoulder, commonly called the *withers*. They are of considerable importance to all long-necked quadrupeds, from their affording a large surface for the attachment of the great ligament which supports the head and neck. All together they form the ridge of the back. On each side of the dorsal vertebræ *transverse* processes are situated, articulating with the ribs; and other smaller oblique projections serving to unite and fit one vertebra to that adjoining. The spinal column has considerable flexibility, as well as very great strength; these essential qualities being due to pads of cartilage interposed between the several bones, and firmly united to them. Besides these there are ligaments running along the broad under surface of the vertebræ; others again between the transverse processes, and similar strengthening ties uniting the upright projections or spinous processes, the whole mass forming a marvel of strength, lightness and flexibility. The ribs (Pl. II, 7), eighteen in number, are jointed to the transverse processes of the vertebræ, and curve with some variations in their outline and direction, down towards

the sternum or breast-bone, to which the first seven or eight of them called the *true* ribs, the number sometimes varying, are attached by their extremities, which to provide the elasticity necessary for the expansion of the chest, are composed of cartilage. The remaining ribs are termed *false* ribs, as they have no individual connection with the breast-bone; they are, however, united together by cartilages, each on its own side, and this cartilaginous union ultimately terminates in the sternum; so that the whole of the ribs are enabled to expand or act in uniformity. The *sternum* (Pl. II, 8), in the young horse consists of six bones, which become united into a single piece in the full-grown animal. The front of this bone is convex and sharply keeled, its upper extremity projecting so as to be easily observed in the living horse. This is known as the "point of the breast," and its place will be easily ascertained when it is remembered that the lowest part of the collar just covers it.

The haunch or pelvis (Pl. II, 11. Pl. XII, 6), is in reality made up of six bones—three on each side, the whole firmly united into one. Of these the *ilium* is the most important, and is strongly secured to the *sacral* vertebræ, which we have already noticed as forming the keystone of the pelvic arch. Lateral prolongations of the *ilium* produce the prominences so conspicuous just above, and in front of the hind-quarters in every horse. The *ischium* or hip-bone is a backward continuation of the *ilium*, and bears a considerable tuberosity which projects on each side a little below the tail. The *pubis*, apparently

a single bone, is connected with those already mentioned, and forms an inverted arch with them below Pl. XII, *d*.

The bones of the limbs next claim our attention.

The natural attitude of the horse being that of a quadruped supported on the *extremities* of its four limbs, and with its body in a horizontal position, there is a greater apparent difference between its skeleton and that of man than really exists, as will be evident after a very slight examination and comparison of the two series of bones composing them.

In Pl. III. we have given a comparative view of the two skeletons in as nearly as possible the same attitude. It will be observed that besides the greater length of jaws and neck in the horse, (although the number and arrangement of the bones in these parts are the same in both skeletons) the principal differences consist in the form of the extremities and the uses to which they are applied. Man rests on the entire length of the foot, and his hands and fingers are constructed for grasping. The horse, on the contrary, is supported on the extreme points of its toes and fingers, reduced on each limb to a single digit, and protected by the nail becoming modified into a hoof. The long-established phraseology of horsemen, brought into use by the necessity for distinguishing the different parts of fore-legs and hind-legs, and the strange confusion resulting from the introduction of new names, and the misapplication of old ones, render a due comprehension of the nature and relation of these

PLATE III.

limbs almost impossible to those who have given no attention to the skeleton of the horse.

Many of the bones in each skeleton are known by the same names, but some parts of the limbs in the horse have been strangely miscalled. We have thought it desirable, therefore, to give in parallel columns, the names of those bones and joints which, although exactly corresponding in man and the horse, are spoken of under different titles in the ordinary description of the two skeletons. Our references to the various woodcuts will show the true relation and correspondence of the several bones, but as we shall have to speak specially of the horse, it will perhaps be desirable to employ the terms generally used in connection with that animal.

NAMES COMMONLY APPLIED TO CORRESPONDING BONES IN MAN AND THE HORSE.

Front Limbs.

Man.		Horse.
Arm (*humerus*)	=	Lower bone of shoulder.
Fore-arm	=	Arm.
Wrist (*carpus*)	=	Knee.
Hand (*metacarpus*)	=	Leg, cannon and splints.
Knuckles	=	Fetlock.
Finger	=	Pastern and foot.

Hind Limbs.

Thigh (*femur*)	=	Upper bone of thigh.
Knee	=	Stifle joint.

Man.		Horse.
Leg	=	Thigh.
Ancle (*tarsus*)	=	Hock.
Heel	=	Point of Hock.
Foot (*metatarsus*)	=	Leg.
Ball of Foot	=	Fetlock.
Toe	=	Pastern and Foot.

The fore-leg or front limb is united to the body of the horse by means of the shoulder which is here said to be composed of two bones, both covered in and hidden by numerous over-lying muscles. The upper bone or shoulder blade has the usual flattened and long triangular shape, and is strengthened by a ridge or crest dividing it longitudinally into two somewhat unequal portions. The shoulder-blade or *scapula* rests on the ribs, the short side or base of the triangle being placed just below the withers, and its point directed downwards and forwards, nearly on a level with the top of the breast bone. The shoulder-blade has no osseous connection or articulation with the body of the horse, but is united to it solely by muscles, which will be spoken of more in detail in our chapter on the shoulder. The clavicles or collar bones, so well known in man and a few quadrupeds, do not exist in the horse. The lower bone of the shoulder, as it is commonly called, corresponds to the *humerus* or upper bone of the human arm. It is a short, thick and somewhat twisted bone articulating by a rounded head with the *glenoid* or cup-shaped cavity at the point of the shoulder-blade. Its lower extremity, which is directed

backwards, terminates in two condyles, receiving between them the head of the principal upper bone of the leg. This portion of the fore-leg, commonly called the arm (*fore-arm*, human,) is composed of two bones, a long one in front termed the *radius* which extends to the knee, and a short one behind called the *ulna*. The latter bone has a long projection above and behind the upper joint, and forms the point of the elbow to which some powerful muscles are attached for extending the arm. It rapidly diminishes in size towards its lower extremity, and terminates in a point before it reaches the knee. In old horses these two bones of the arm become firmly united into one.

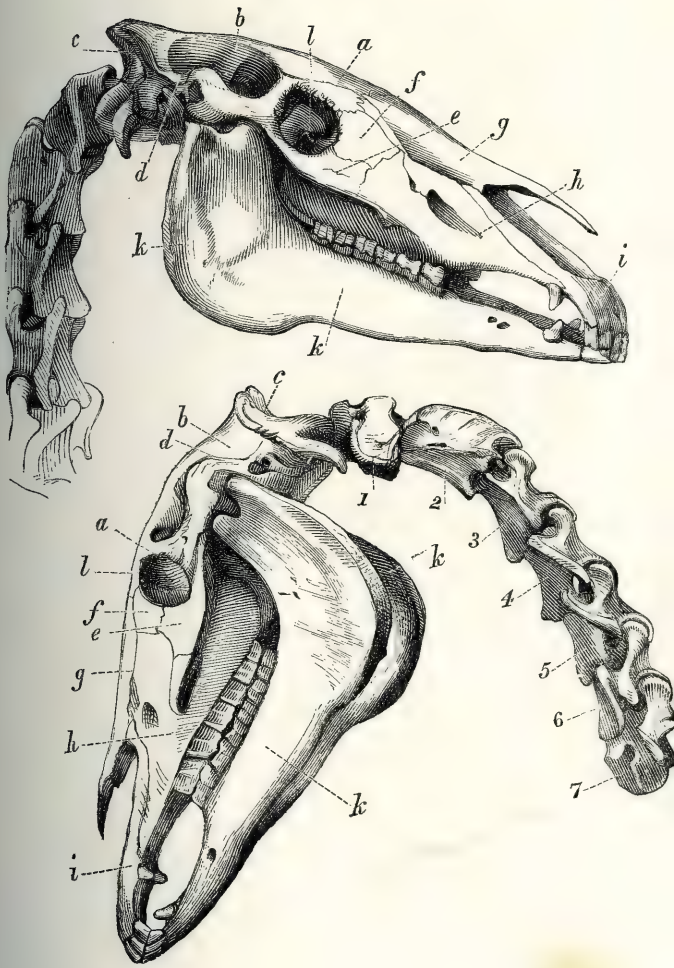
The knee is a complicated joint uniting the arm to the shank or leg, and is composed of six small bones interposed between the upper and lower portions of the fore-leg. We shall have occasion to describe the structure of this important joint at greater length in a subsequent chapter. Below the knee are the metacarpal bones or those of the leg. They are three in number, the cannon, and two splint bones behind. They represent the bones of the human hand, those between the wrist and the fingers. The remaining bones of the fore-leg are the upper and lower pasterns, and the coffin bone surrounded by the hoof or nail, together forming a single stout finger—the only one developed.

In the hind-leg we find a very similar arrangement of the bones. We have already spoken of the pelvic arch, made up of the several bones of the haunch. At

a point on the outer surface of the pelvis, and at the junction of the three component bones on each side, a deep cup-shaped cavity called the *acetabulum* is formed to receive the round head of the true thigh bone or *femur* (Pl. XII. *e*). Great strain is thrown on this joint, it is therefore well protected by the bony cup or *acetabulum*, to whose centre the head of the femur is further secured by an exceedingly strong ligament. The *femur* or true thigh bone is so much concealed by the large muscles of the hind quarters that its true relations, or even its existence may not be recognized in the living horse. This circumstance has led to the confusion of names into which horsemen have fallen when speaking of the different parts of the hind leg.

The lower extremity of the femur is united to the bones of the true leg (*tibia*) by the "stifle joint," which also includes the *patella* or knee cap (Pl. XII. *f*.), this joint corresponding to the knee in human anatomy. The bones of the leg ('thigh,' of horsemen) are the *tibia* and *fibula* (Pl. XII. *g. h.*) articulating below with the numerous small bones of the ancle. The "hock" (Pl. XII. *i.*) is formed by a number of small bones, one of them having an elongated lever-like form with its free extremity directed upwards. This is the *os calcis* or bone of the heel. Into this bone the tendons of several powerful muscles are inserted, and a great deal of the springing power of the horse, as well as in other jumping animals, is due to the position and action of this part of the hinder limb.

PLATE IV.



The remaining bones of the hind leg agree generally with those of the corresponding portions of the anterior limb.

PLATE IV.

Figs. 1 & 2.

BONES OF THE HEAD AND NECK.

a. Frontal.
b. Parietal.
c. Occipital.
d. Temporal.
e. Malar.
f. Lacrymal.
g. Nasal.
h. Superior maxillary.
i. Pre-maxillary.
k. Inferior maxillaries or lower jaw.
l. Orbit.
1. Atlas.
2. Dentata.
3. Third.
4. Fourth.
5. Fifth.
6. Sixth.
7. Seventh.

} Cervical vertebræ.

The bones of the head may be divided into two groups, those of the cranium and of the face. The cranial bones include all those which cover or enclose the brain. They are for the most part arranged in pairs, one on each side

of the mesial line of the skull, but may conveniently be spoken of as single bones.

The *frontal*, or bone of the forehead (*a*) forms the broad flat surface between the eyes, and extends with a narrowing outline towards the top of the head. The *frontal* occupies the widest part of the head. Considerable difference in the width of this bone may be noticed in various horses, and it will generally be found that the broad and ample forehead is a mark of high breeding and superior intelligence in the animal, as is often sufficiently indicated by the expression of the face. The *parietal* (*b*) extends backward from the frontal to the poll. It has a ridge or crest of great strength and hardness along the upper surface, from which the bone slopes down like a roof on each side, covering the brain, which it is mainly concerned in protecting.

Immediately behind the *parietal*, and covering the entire back of the head, is the *occipital* (*c*), a bone whose position exposes it to greater strain than any of the other component parts of the skull are liable. The *occipital* has to support the whole weight of the head, which is articulated by two rounded protuberances or *condyles* at the base of this bone to the *atlas* or first vertebra of the neck. On the outer sides of the *occipital*, and beyond the *condyles*, are two styliform processes or pointed projections for the attachment of some of the muscles of the neck which assist in supporting the head.

The *temporal* bone (*d*) unites above with the *parietal*, and behind with the *occipital*. It contains the internal

parts of the ear, and has a depression or hollow beneath for the articulation of the lower jaw. Anteriorly, this bone joins the extremity of the *frontal*, and continuing forward unites with the *malar* or cheek-bone *(e)*, making up the *zygomatic arch*, and forming the greatest part of the orbit, which is completed by the *lacrymal (f)*, a small facial bone at the inner corner of the eye. Immediately before the frontal is the *nasal* bone *(g)*, one of the principal bones of the face, and covering the delicate membrane of the nose. The *superior maxillary (h)*, is a large bone occupying the side of the face. It carries all the molar teeth or grinders and the tusk of the upper jaw. The nippers or incisor teeth are inserted in the *pre-maxillary* (*i*), which uniting with the two bones last mentioned completes the frame-work of the nose. The lower jaw consists of two bones only, the *inferior maxillaries* (*k*). These are rounded at the hinder extremity of the jaw and terminate in two processes directed upwards.

The terminal projection or *condyloid process* articulates, with the *temporal* bone at the base of the *zygomatic arch*, and forms the hinge on which the whole lower jaw moves. The second process, termed the *coronoid*, passes under the arch, and receives the lower end of the large *temporal* muscle which arises from the parietal bone, and is principally concerned in moving the jaw in the act of mastication. There are also two small bones, in the lower part of the cranium, under the *parietal*, the *sphenoid*, and *ethmoid;* they serve to connect the principal bones of the skull, but, as they are not visible externally,

they do not need description for artistic purposes. The bones of the neck, as we have already mentioned, are seven in number. The *atlas*, which articulates with the skull, is a ring-shaped bone with broad lateral projections, but without any other prominent characters. It has great freedom of motion on the second bone, or *dentata*, and on the peculiar articulation of these two vertebræ the power of turning the head mainly depends. The remaining five bones of the neck closely resemble one another; they have various small processes for the insertion of muscles and ligaments, and their form will be sufficiently understood by an examination of Plate IV.

PLATE V.

Figs. 1 & 2.

MUSCLES OF THE HEAD AND NECK.

Head.

a. Masseter.
b. Temporalis.
c. Orbicularis.
d. Levator.
e. Orbicularis oris.
f. Dilator naris lateralis.
g. Zygomaticus.
h. Nasalis labii superioris.
i. Depressor labii inferioris.

PLATE V.

Neck.

j. Complexus major.
k. Splenius.
l. Levator anguli scapulæ.
m. Hyoideus.
n. Sterno-maxillaris.
o. Levator humeri or deltoides.

The muscles of the head are not very numerous, and those requiring the most attention will be found in the immediate neighbourhood of the mouth and nostrils.

The largest superficial muscle is the *masseter*, (Pl. V, fig. 1, 2 *a*). This forms the cheek of the horse, and extends along a ridge by the side of the head, below the eye, to the rounded posterior angle of the lower jaw which has a roughened surface for its more secure attachment. Its action is to close the mouth. The *temporal* muscle (*b*) also assists in this office. It arises from the medial ridge of the parietal bone, clothing its roof-like walls, and is inserted within the zygomatic arch to the coronoid process of the lower jaw-bone. The dimpling which may be observed, during mastication, above the eye of the horse is produced by the action of this muscle in alternately raising and depressing the under jaw. The *orbicularis* (*c*) is a circular muscle surrounding the eye and closing the eyelids. Above the eye, and directed inwards and upwards is a small *levator* muscle (*d*) which passes over the *orbicularis* and raises the upper eyelid.

The muscles of the ear are not very conspicuous. Three of them may be shortly noticed. The first proceeding from the base of the ear extends a short distance forward and turns it in that direction; the second, behind the ear, directs it inward and backward, and the third descends as a narrow strip at the back of the cheek to incline the ear outward.

The frontal and nasal bones have no prominently perceptible muscular covering; the difference in the shape of these parts in various horses being entirely due to the variation in the relative size and proportion of the particular bones.

Of the muscles of the lips and nose we may first mention the *orbicularis (e)*, one of the most important of them. It entirely surrounds the mouth, and by its action the lips are pushed out or closed. This muscle is brought into play whenever the lips are required to seize or hold anything between them. The *dilator naris lateralis (f)* is a pyramidal muscle covering the whole exterior of the nostril and having its origin close to the anterior point of the masseter. It is the great *side* dilator of the nostril, and also raises the upper lip. The *zygomaticus (g)* draws back the corner of the mouth whence it may be traced upward, outside the masseter to its origin on the zygomatic arch. The *buccinator*, a muscle on the inside of the mouth and cheek, and consequently scarcely visible externally, has the same office as the preceding.

The *nasalis labii superioris (h)* extends from a depres-

sion in front of the eye towards the angle of the mouth, a short distance above which it divides into two parts, the side dilator of the nostril *(f)* passing between them. One of these portions is continued straight to the corner of the mouth which it raises; the other part expands under the side dilator, and assists it in the office of dilating the nostril. It also helps to lift the upper lip.

The under lip is drawn back by the *depressor labii inferioris* (*i*), a narrow muscle which is inserted into the lip below the angle of the mouth, and passing along the side of the jaw, disappears under the masseter.

Independently of the muscles for supporting the head and neck there is a very beautiful and simple arrangement by which those parts are kept in an easy and natural position when the horse is at rest. This consists of a very strong and elastic ligament called the *ligamentum nuchæ*. It takes its origin from the back of the occipital bone to which it is attached immediately below the crest. At first it is in the form of a stout round cord. It passes over the *atlas*, or first joint of the neck, to allow full freedom of motion to the head, and is strongly adherent to the *dentata*, on which the principal strain from the weight of the head is thrown; it then proceeds backward to its termination on the elevated spinous processes of the first dorsal vertebræ. The *withers* as these elevated parts are called have thus an important office—that of supporting the weight of the entire head and neck when in their ordinary position. But provision must

also be made for lowering and raising the head, and for these purposes there are special muscles. The first to be noticed is the *complexus major* (Fig. 1. *j*). It arises from the transverse processes of the four or five first dorsal vertebræ, and also from the five lower bones of the neck; the fibres from these two points uniting to form one large muscle which diminishing in size in the direction of the head terminates in a tendon inserted into the occipital bone. This muscle makes up the principal portion of the lower part of the neck. Immediately above this is the *splenius* (*k*) specially employed in raising the head. It arises from the entire length of the *ligamentum nuchæ* and is directly inserted into all the bones of the neck, except the first, with which, however, and the temporal bone of the head, it has a separate and less distinct connection. To the form and development of the splenius, the beauty of the neck of the horse is mainly due. It is here the greatest thickness is found; and from being sometimes overloaded with cellular substance or fat, an appearance of clumsiness may be produced. The thick crest and massive neck of the entire horse are to a large extent due to the abundant development of this muscle; and the student or amateur will do well to acquire a thorough knowledge of its form, which, in every condition and breed of the horse so largely contributes to give a character to the neck.

Behind the splenius, and extending along the superior margin of the neck is the *levator anguli scapulæ* (*l*). It is inserted into the back of the head, and attached to the

first four bones of the neck as well as to the great ligament, then descends to the shoulder where it is not visible externally. It has a reciprocal action on the neck and shoulder according to whichever is the fixed point at the time.

Of the muscles in front of the neck we may first direct attention to the *hyoideus* (Plate V, fig. 2, *m*). Its upper extremity is always conspicuous immediately below the head at its junction with the neck. It is attached to the hyoid bone of the tongue, which it retracts, and descends along the front of the neck to the shoulder, but is covered in the greatest part of its length by other muscles, and is only visible for a short distance below the head. Outside this muscle, and partly covering it, is the *sterno maxillaris* (Plate V. *n*), the principal depressor of the head. It arises from the upper end of the sternum or point of the breast, covers the lower front of the neck, then proceeding upwards by the side of the hyoideus, is inserted by a flat tendon into the posterior angle of the lower jaw. It is not a very large muscle, for, when those supporting the head and neck are relaxed, but little force is required to pull the head down.

Beyond the sterno-maxillaris, and extending from the back of the head and upper part of the neck, along the front of the shoulder, to the top of the fore-leg, is the *levator humeri* or *deltoides* (Plate V. *o*), a long and very important muscle, having, in fact, a double function to perform. When the head is kept up by its own proper muscles, it becomes a fixed point from which the *levator*

humeri is enabled to raise the shoulder. This is probably its principal office. Its action, however, can also be reversed, and with the shoulder for a fixed point, the head can be depressed, a small slip of the muscle being carried forward to the point of the sternum to pull the head in that direction.

NOTE.—It must be borne in mind that, with very few exceptions, the muscles are all arranged in pairs, sometimes though rarely in contact, and that in speaking of them in the singular number, unless otherwise stated, we are referring to their position and function on each side of the animal.

BONES AND MUSCLES OF THE SHOULDER.

The shoulder-blade or *scapula* (Plate II, 9, Plate X. fig, 1, *a*) consists of a single bone, and connects the fore-leg with the trunk, corresponding in its relation to that of the haunch bone to the hind-leg. There is, however, this important difference between them, the haunch bones are anchylosed or united to the sacral portion of the back-bone in order to provide a firm point from which those powerful levers, the hind-legs can act; the shoulder, on the contrary, has to receive a violent shock from the weight of all the front part of the animal suddenly falling on the fore-legs. The shoulder has therefore only a muscular attachment to the trunk; and by this arrangement no jar is received by the spine, and any

injury to the important viscera of the chest is rendered unlikely.

The shoulder-blade is of a long triangular form, with its apex directed downwards, nearly on a level with the point of the breast, and its somewhat rounded base resting on the ribs immediately below the withers. It is divided externally into two portions by a ridge or crest running nearly the length of the blade, and a little on one side of its mesial line. This ridge of bone gives additional firmness to the shoulder-blade, and affords a surface for the attachment of some very important muscles. At the lower extremity of the shoulder-blade is a cup-shaped hollow, called the *glenoid cavity*, with which the rounded head of the bone (*humerus*) of the shoulder articulates. Above this joint, on the anterior edge of the scapula, is the *acromion process*, to which in man and some few quadrupeds the clavicle or collar bone is united. This bone, however, is not found in the horse, or in other animals which have but little power of lateral motion in the front limbs.

Following the custom of horsemen, and adopting their nomenclature for the bones of the horse, we shall next speak of the "lower bone of the shoulder" the *humerus* (Plate II, 10, Plate X, fig. 1, *b*), in every respect corresponding with that part of the human arm which extends from the shoulder to the elbow, but which, in the horse, is so hidden by the muscles as not to be externally visible as a distinct bone of the front limb. The lower bone of the shoulder is short and strong; it articulates

by a rounded head with the glenoid cavity of the scapula, and has considerable freedom of motion. Its direction is backwards, and at almost a right angle with the shoulder-blade. It has several large protuberances at the upper end of the bone, and to which are attached the principal muscles for moving it. The lower extremity terminates in two condyles or heads between which the superior end of the arm-bone is received.

PLATE VI.

MUSCLES OF THE SHOULDER AND BACK.

x. Trapezius.
a. Pectoralis minor.
b. Antea spinatus.
c. Postea spinatus.
d. Teres minor.
e. Anconæus longus.
f. Anconæus externus.
g. Serratus major.
**.* Latissimus dorsi.
p.m. Pectoralis major. See Plate XIV.

Of the muscles of the shoulder we may first notice the *trapezius* (Plates I, VI, XIV). It rises from the ligament of the neck and the principal bones of the withers, and terminates in a pointed shape on a prominent part of the ridge of the shoulder-blade. Its office is to raise and support the shoulder, assisting the *serratus major*

PLATE VI.

(Plates I, VI, *g*), a very important muscle, but hardly visible externally, as it is principally situated between the shoulder-blade and the ribs of the horse, forming the main connection between them.

The *antea spinatus* (Plates I, VI, XIV, *b*), taking its name from its situation, occupies the outer surface of the scapula on the front side of the spine or ridge of that bone. It proceeds to the lower bone of the shoulder, and, dividing into two parts, is inserted into the two prominences in front of it, extending the bone forwards. The *postea spinatus* (Plates I, VI, XIV, *c*) is situated on the other side of the spine of the shoulder-blade, and is inserted into the upper and outer head of the bone, drawing it outward and raising it. Behind the *postea spinatus* is a small muscle called the *teres minor*, (Plates I, VI, XIV, *d*), or little pectoral; it draws the shoulder forward towards the breast. The *pectoralis major* (Plate XIV, *p.m.*) is conspicuous inside the arm at its junction with the body. It is an important muscle, and pulls the whole fore-leg inwards, keeping it on a line with the body and ensuring an even and regular action of the limb. On the outside of the shoulder, and readily seen in the living horse when in motion, are two muscles, which, arising from the lower bone of the shoulder, are inserted into the point of the elbow. They are called the *anconæus longus* (Plates I, VI, XIV, *e*), and the *anconæus externus* (Plates I, VI, XIV, *f*). Their office is to straighten and extend the arm, in other words, to bring the front limb into a perpendicular position, and as nearly as possible

in a line with the *humerus*, or, as we have called it, the "lower bone of the shoulder." The muscles which bend the arm upwards are not visible externally, but are almost entirely covered by those of the shoulder.

The muscles of the back do not require any lengthened notice. The *latissimus dorsi* (Plates I, VI, XIV) is the most important; it covers the whole back, extending from the shoulder to the haunch, and is strongly attached to the processes of the vertebræ, and the ribs. This muscle is the principal one employed in raising the fore or hind quarters in the act of rearing or kicking. That part of it which comes nearest to the surface is generally covered by an ordinary saddle, but no portion of this muscle is at any time very distinctly visible.

PLATE VII.

BONES AND MUSCLES OF THE FRONT LIMBS.

FIG. 1.—*Bones.*

A. Radius.
B. Ulna, point of.
C. Knee (*carpus*).
D. Cannon or Shank.
E. Splints.
F. Sesamoids (behind Fetlock).
G. Upper and Lower Pasterns.
H. Coffin Bone.
I. Navicular.

PLATE VII.

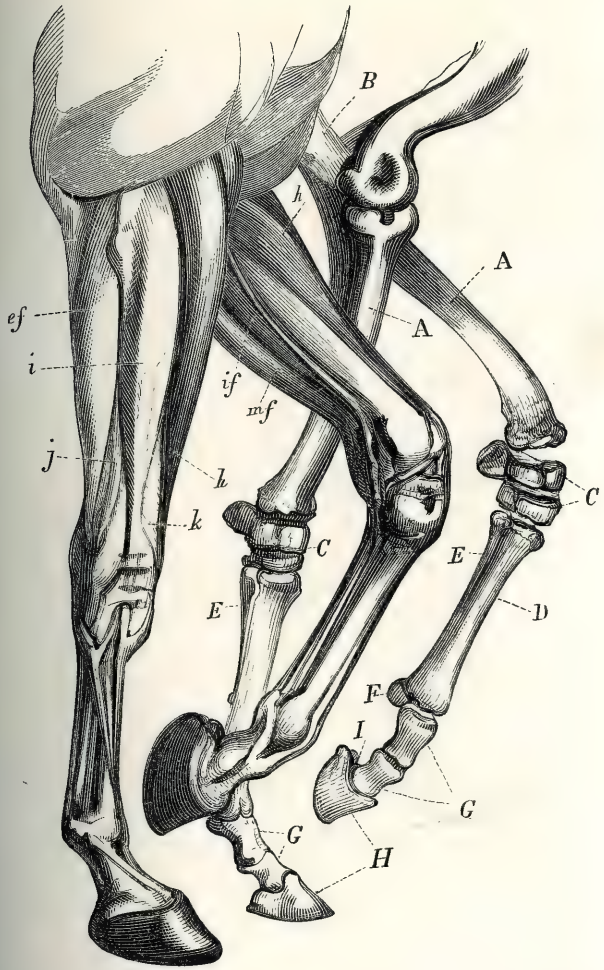


FIG. 2.—*Muscles.*

h. Extensor carpi radialis.
i. Extensor digitorum longior.
j. Extensor digitorum brevior.
k. Abductor pollicis longus.
ef. External Flexor.
mf. Middle Flexor.
if. Internal Flexor.

The upper portion of the fore-leg, or, as it is commonly called in the horse, the arm, (*fore-arm*, human) extending from the elbow to the knee (*carpus*), consists of two bones, the *radius* and the *ulna*. The *radius* (Fig. 1, A) is the more important of the two, and in the young horse is the great support of the leg. It is the long front bone, is nearly straight, and receives into depressions on its upper end the two heads of the inferior extremity of the lower bone of the shoulder. The other end of the *radius* fits on to the upper layer of the bones of the knee (*carpus*). The *ulna* (fig. 1. B) is situated behind, and to some extent above, the *radius*, there being a considerable projection of the former received between the heads of the lower bone of the shoulder, and called the elbow. This forms a powerful lever into which are inserted the muscles for extending the arm as already noticed in our account of the muscles of the shoulder. The ulna is continued downwards, gradually diminishes in size, and terminates in a point behind the middle of the radius. These two bones of the arm are at first distinct and

separate, but before many years have past the cartilaginous and ligamentous connection between them becomes ossified, and the two bones are firmly united into one.

The knee, (Fig. 1, *c*) corresponding to the human wrist (*carpus*), is a part of the fore-leg to which the attention of the artist should be particularly directed, as its form is always a characteristic and prominent feature in the outline of the horse, and one to which, like the hand in the drawing of the human figure, severe scrutiny is likely to be applied. The knee is a complicated joint, that is, it is composed of numerous small bones interposed between the lower end of the radius and the upper extremity of the shank or *cannon* bone.

The position and action of this joint render it peculiarly liable to external injury and violent jars or strains; it is therefore so made up that any shock it may receive will be distributed over a number of distinct bones, each protected by a covering of cartilage, and resting on a kind of semi-fluid cushion, the whole being strongly united together by ligaments.

PLATE VIII.

BONES OF THE KNEE (*carpus*).

FIG. 1. *Left leg, outer side.* FIG. 2. *Front view.*

a. Radius.
b. Pisiforme.

PLATE VIII.

FIG. 1.

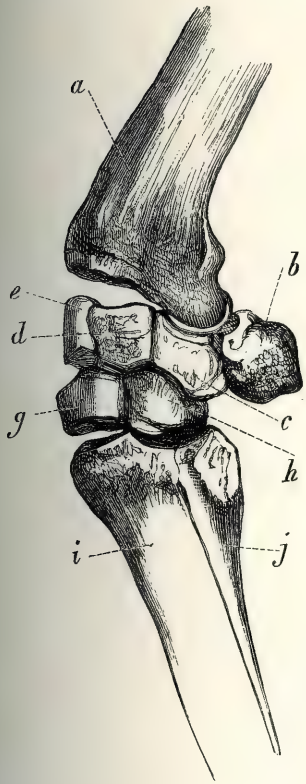
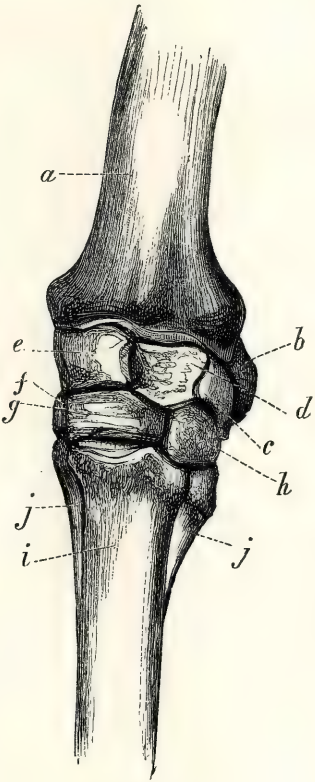


FIG. 2.



c. Cunieforme.
d. Lunare.
e. Scaphoides.
f. Trapezoides.
g. Magnum.
h. Unciforme
i. Cannon. } Metacarpals.
j. Splint. }

The true carpal bones are seven in number, six of them being placed in two rows, each containing three bones, in front of the joint, and the seventh, the *pisiforme* (Plate VIII, figs. 1-2, *b*), by some persons called the *trapezium*, being situated behind them, forming the point of insertion for some of the muscles of the arm, and otherwise aiding in the protection of the tendons running down behind the leg. By reference to Plate VIII, the shape and arrangement of the bones of the knee will be readily understood. Besides the advantage of distributing a shock over several distinct parts, there is another object to be gained by the interposition of these small bones. The bending of the leg at this point can be carried so far that a very wide opening between the bones of the arm and the shank would necessarily be the result, and this would take place at a part extremely liable to external injury. By the presence and arrangement of the interposed carpal bones, however, this wide opening is replaced by three narrow ones, which are well protected from all ordinary dangers by being covered with a capsular ligament, extending from

the radius above, to the shank bone below them. A large flat knee has always been considered a valuable point in a horse, and from what we have shown of the action of this joint, the advantages of its possessing a considerable extent of surface will be sufficiently evident.

Between the knee and the fetlock are three bones, the *cannon* or *shank*, and two *splint* bones, the whole making up what is called the leg (*metacarpus*, human). The *cannon* or *shank* bone (Plate VII, fig. 1, D), articulates at its upper extremity with the lower row of the bones of the knee, and at the other end with the upper pastern at the fetlock joint. It is the principal bone of this portion of the leg, and is almost entirely devoid of any muscular covering, those parts of it which are not hidden by tendons being only protected by the skin. This bone is nearly straight, rounded in front, and flattened or slightly concave behind. The *splint* bones (Fig. 1, E) are situated behind the cannon and a little on each side of it. They also articulate with the lower bones of the knee, and throughout their length are united by cartilage and ligaments to the cannon bone. The name given to these bones well describes their character, they are "splints"—slender pieces attached to the cannon to strengthen it, and diminishing to a point before they reach the fetlock joint (Plate IX, *c*). Behind this joint are two small supplementary bones termed *sesamoids* (Plate IX, *b ;* Plate VII, fig, 1, F.) ; they serve to protect the back of the joint and some important ligaments passing over it.

PLATE IX.

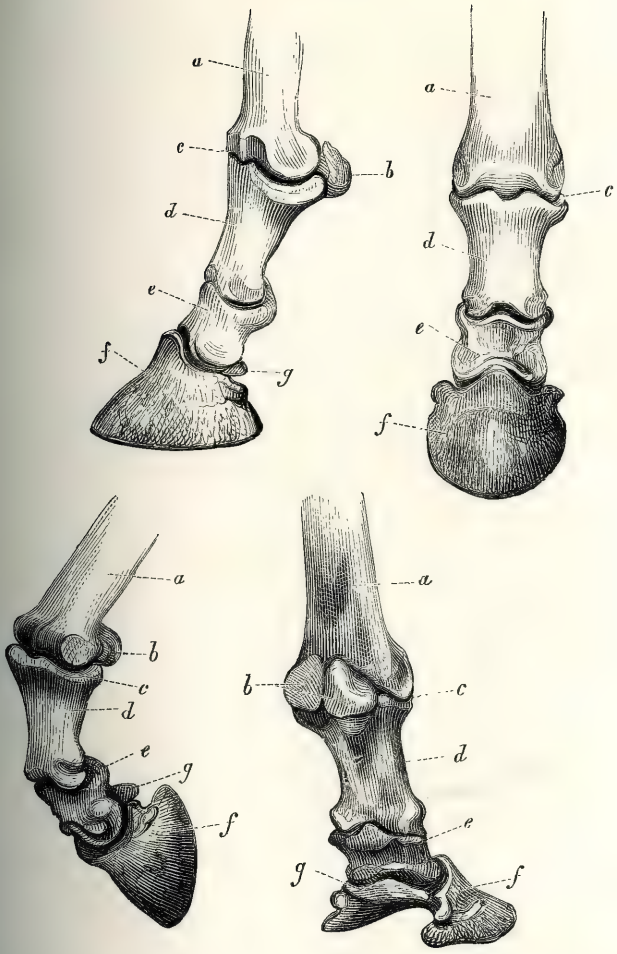


PLATE IX.

FIGS. 1—4.

Bones of Foot.

a. Cannon or Shank.
b. Sesamoids.
c. Fetlock joint.
d. Upper pastern.
e. Lower pastern.
f. Coffin bone.
g. Navicular bone.

The two next bones in descending to the foot are the *upper and lower pasterns* (Plate IX, *d*, *e*, Plate VII, fig 1, G); these have considerable motion one on the other to allow the foot to be bent back. The toe is formed by the *coffin* bone, (Plate IX, *f*, Plate VII, fig. 1, H) which is surrounded and covered in by the horny hoof, so that its form is never visible externally. For all artistic purposes, the shape of the hoof need only be considered. Another small bone called the *navicular* (Plate IX, *g*, Plate VII, fig. 1, I) is found behind, and partly within, the junction of the coffin and lower pastern, and like the former bone is enclosed by the hoof.

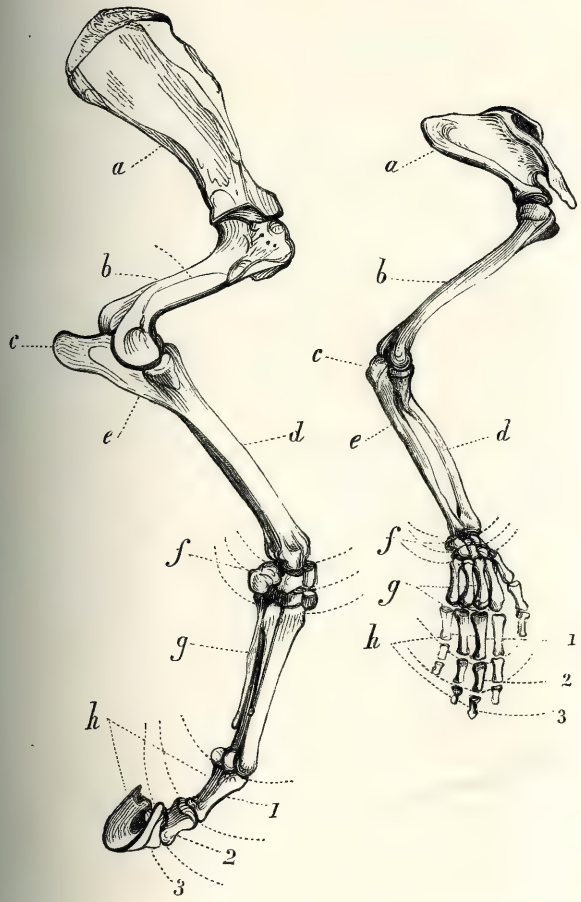
PLATE X.

COMPARATIVE VIEW OF THE BONES IN THE FRONT LIMBS OF MAN AND THE HORSE.

a. Scapula.
b. Humerus.
c. Olecranon or elbow.
d. Radius.
e. Ulna.
f. Carpus.
g. Metacarpus.
h. Digit.
1. Phalanx.
2. Do.
3. Do.

In order to render more intelligible the relation of the several bones of the fore-leg in the horse to those of the human arm and hand, there is given in Plate X, a comparative view of those parts of the two skeletons, by which it will be seen that any differences existing between them are due to alterations in the shape or proportions, or in some cases, to the suppression or undevelopment of particular bones, but not to any departure from the general plan on which both skeletons are constructed. A general agreement in form, although not in proportions, will be noticed in the shoulder blades (*a*) and the *humeri* (*b*) or first bones of the actual limbs; the same

PLATE X.



may be observed in the next bones of the series, but with a slight modification. The *radius* (*d*) is the same as in both skeletons, but the human *ulna* (*e*) is completely developed, and terminates at the wrist (*carpus*) which gains additional power of motion by its articulation with this second bone. There is also a general correspondence in the carpal bones (*f*). In the metacarpals, (*g*), however, we find an important distinction. The five bones bearing this name in the human hand are reduced to three in the front limb of the horse, where they are considerably increased in relative size, and are known as the *cannon* and *splint* bones. Only one of the fingers is developed in the horse, the middle digit, corresponding to the middle finger (*h*) of the human hand, and the three bones composing it are in the horse known as the two *pasterns* (1-2), and the *coffin* bone (3). The hoof, as we have before mentioned, is only a modified form of nail. In the accompanying woodcut those bones of the human hand which have their homologues in the horse will be found strongly indicated.

The muscles of the fore-leg may be divided into two groups, those in front, and on the outer side of the limb; and those which may be seen from behind, and on the inside.

The fleshy portions of all these muscles are placed above the knee (*carpus*), and only their tendinous prolongations are continued to the several bones of the lower part of the leg and foot.

The principal muscle in front of the so-called "arm"

of the horse is the *extensor carpi radialis*, (Plates I, VI, VII, XIV, *h*).

It arises from the lower part of the lower bone of the shoulder, and descends in front of the arm to the knee where it becomes entirely tendinous. It then passes over the knee, under a band of ligament which crosses that joint, and is finally inserted in front of the cannon bone. The action of this muscle is to strengthen the lower part of the leg. Next to this muscle are those whose office it is to extend the foot, the *extensor digitorum longior* and *extensor digitorum brevior*, Plates I, VI, VII, *i. j.*) Their origin is much the same as that of the extensor of the leg, but the tendons pass by the side of the knee, under the capsular ligament of that joint, down in front of the leg and of the fetlock joint to be inserted into the pasterns and coffin bone. The first of these muscles is conspicuous on the outside of the arm, but the second is in a great measure hidden by its companion.

A small oblique muscle the *abductor pollicis longus* (Plates I, VII, *k*), appears from under those last mentioned, and obliquely crosses the knee; it assists the others in extending the leg.

On the outside of, and rather behind the arm is the most external of the muscles which bend the leg, the *flexor carpi ulnaris*, or external flexor (Plates I, VI, VII, XIV, *ef*). It arises from the outer head of the lower bone of the shoulder, and descends towards the knee, the tendon dividing into two parts, one of them being

inserted into the *pisiforme* (Plate VII, fig. 1), the seventh bone of the knee, and conspicuous behind that joint, the other going to the outer splint bone. On the inside of the leg, and behind it is the middle flexor (Plates VII, XIV, *mf*) springing from the inner hand of the lower bone of the shoulder and terminating, like the outer flexor, at the *pisiforme*. These two muscles are the principal flexors of the leg, and are assisted in their office by the internal flexor (Plates I, VII, XIV, *if*) which having much the same origin as the others, is inserted into the inner splint bone. The muscles which bend back the foot are deeply seated, and covered by those we have just described. The tendons in which they terminate will be seen in the several figures in Plates I, VI, VII, XIV.

BONES OF THE HIND LIMB.

It will be unnecessary to give any detailed account of the bones of the haunch, as they have been sufficiently described in our general sketch of the skeleton. We shall therefore now proceed to point out the characters of the bones of which the hind leg is composed.

Beginning at the upper extremity of the limb, the first bone to be noticed, is the *femur* or true thigh (Pl. XII. *e*); and here we must direct the student's attention to the list of the names applied to corresponding bones in the skeletons of man and horse, (see page 13)

that he may become familiar with the true relation of the several parts of the hind leg, so commonly misnamed when speaking of the horse. We shall, as before, use the forms most familiar to the equestrian, explaining them as may appear desirable for the due comprehension of the subject. This bone (*femur*) is so entirely hidden by various muscles of the haunch as to be unrecognised and unnamed by those persons who are not acquainted with anatomy. We shall speak of it as the "upper bone of the thigh," a term that may be easily remembered by those who apply the name of "thigh" to the next lower bone of the series.

The "upper bone of the thigh" (*femur*) is exceedingly strong and stout. It is short for its bulk, which is further augmented by several large projections or *trochanters* placed longitudinally for the attachment of some important muscles. The upper extremity of the femur has a distinct rounded head on the inner side, fitting into and articulating with the *acetabulum* or bony cup formed at the junction of the three pelvic bones. The lower end of the bone bears two prominences which fit into corresponding depressions in the next bone, and in front of which is placed the *patella* or knee-cap (Pl. XII. *f*) together making up the "stifle joint" of horsemen, or, more strictly speaking, the actual "knee" of anatomists. The "thigh" (*leg*, human) consists of two bones, the *tibia* (Pl. XII. *g*) and the *fibula* (Pl. XII. *h*). The tibia extends from the stifle joint, which it helps to form, to the "hock" (*ancle*, human). The fibula is

PLATE XI.

FIG. 1.

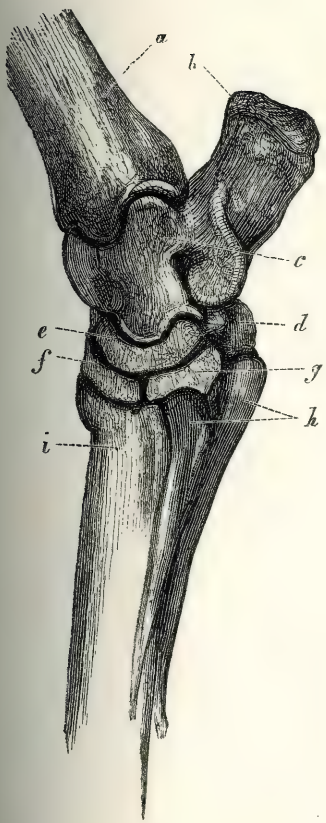
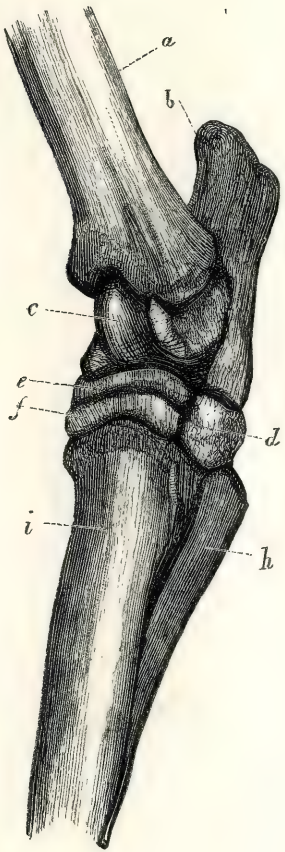


FIG. 2.



placed behind on the outer side of it, extending from its upper extremity to about one third of its length. It is attached to the larger bone by cartilage, and agrees in general character with the small bone or ulna in the fore-leg.

PLATE XI.

BONES OF THE HOCK *(tarsus)*.

FIG. 1. *Back view, inner side.* FIG. 2. *Front view, outer side.*

a. Tibia.
b. Os calcis.
c. Astragalus.
d. Cuboides.
e. Naviculare.
f. Outer cunieforme.
g. Middle cunieforme.
h. Splint.
i. Cannon or Shank.

NOTE.—As the great toe is unrepresented in the horse, the *inner cunieforme* is not developed.

The *hock* (Pl. XI) is an important and somewhat complicated joint. It corresponds to the ancle and heel in man, although, in the horse, it is at some distance from the ground. Like the knee of the horse (*carpus*) the hock (*tarsus*) consists of several small bones interposed between the long ones of the lower part of the limb.

They are six in number, and of various shapes, for a knowledge of which we must refer the student to Plate XI. which gives a front and inner side view of the joint with the several bones in their natural position. We may, however, direct attention to the projecting bone at the back of the joint. This bone, the *os calcis* or heel bone forms what is called the "point of the hock." It acts as a lever to straighten the leg, and is moved by the *tendo Achilles* and other tendons arising from the muscles which spring from the upper part of the limb. It is considerably developed in all fast moving animals, an increase in the length of the lever adding considerably to the force of the spring.

PLATE XII.

COMPARATIVE VIEW OF THE BONES OF THE PELVIS AND HIND LIMBS OF MAN AND THE HORSE.

a. Sacrum.
b. Ilium.
c. Ischium. } Pelvis.
d. Pubis.
e. Femur.
f. Patella.
g. Tibia.
h. Fibula.
i. Tarsus.
j. Metatarsus.

PLATE XII.

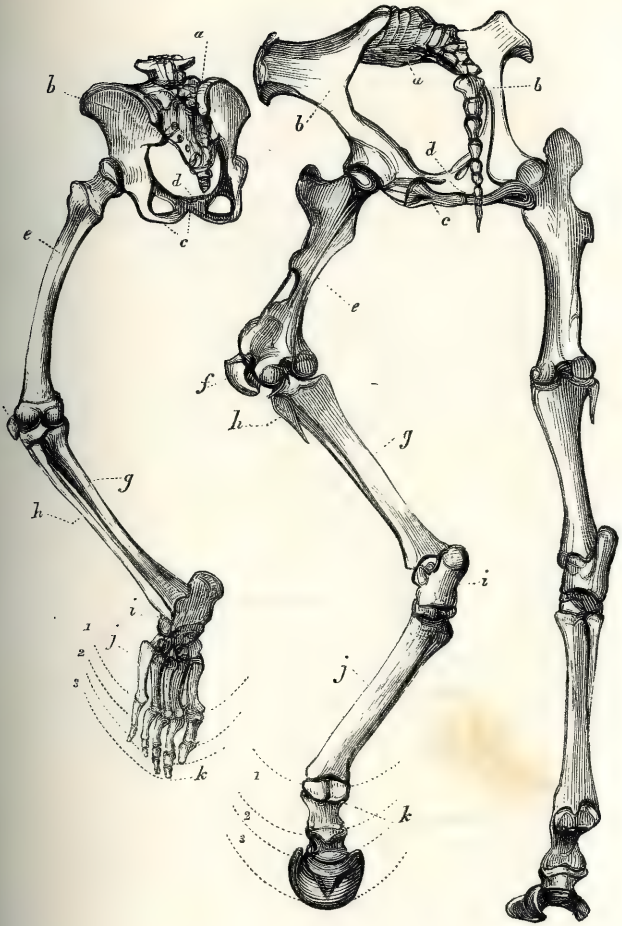
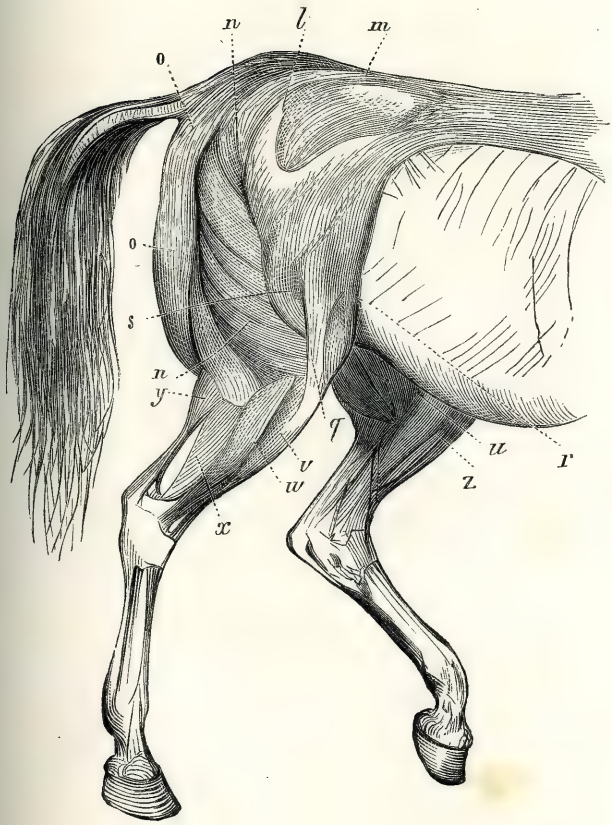


PLATE XIII.



k. Digit.
1. Phalanx.
2. Do.
3. Do.

The remaining bones of the hind-leg do not require any lengthened description, as they agree generally with those in the lower part of the fore-leg. The "leg" (*metatarsus*, Pl. XII. *j*) is composed of the shank and two splint bones, the former uniting at the fetlock joint with the upper pastern, which is followed by the other bones of the toe, as in the front limb.

In Plate XII. we have given a comparative view of the hind limbs of man and the horse, by which the true nature and relations of the several bones may be readily understood, and to which our observations on a similar comparison of the front limbs are generally applicable.

PLATES XIII & XIV.

MUSCLES OF THE HIND QUARTERS.

l. Glutæus externus.
m. Glutæus medius.
n. Triceps femoris.
o. Biceps.
p. Semi-membranosus, Plate XIV.
q. Musculus fasciæ latæ.
r. Rectus.
s. Vastus externus.

u. Gracilis.
v. Extensor pedis.
w. Peronœus
x. Flexor pedis.
y. Gastrocnemi.
z. Flexor metatarsi.

Under this heading we shall include all the muscles which are concerned in, and connected with, the motion of the hind limbs.

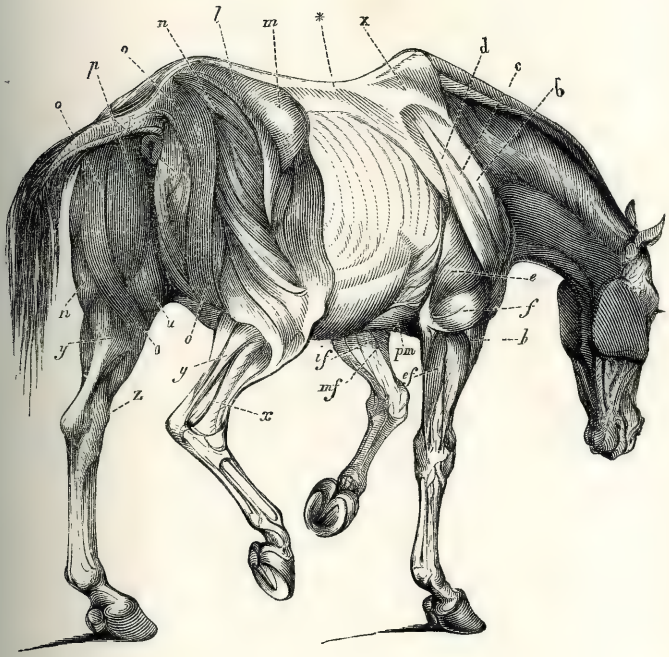
The muscles of the hind quarters are for the most part strongly marked, and the situation of the principal ones easily recognised.

Prominent on the front and outer part of the haunch is the *glutæus medius* (Pls. I, XIII, XIV, *m*). It arises from the processes of several of the vertebræ of the loins, and from the prominent parts of the ilium, terminating at its insertion in the great trochanter or projection on the upper bone of the thigh (*femur*). It is a very important muscle, and acts with considerable power in raising and bringing forward the femur. It has been called the "kicking muscle."

The *glutæus externus*, (Pls. I, XIII, XIV, *l*) is a slender muscle attached to the *glutæus medius*, having a generally similar origin and function.

Among the most conspicuous muscles of the hind quarter, especially when the horse is in motion is the *triceps femoris* (Pls. I, XIII, XIV, *n*), or three-headed muscle of the thigh (*femur*). Strictly speaking it is made up of three muscles, but as they are united and

PLATE XIV.



have a common action, it will be convenient to speak of them as one. It takes its origin from several of the bones of the spine, including some at the root of the tail, and from various parts of the haunch bones; it then curves downwards and forwards, dividing into three heads which are inserted broadly into the upper part of the lower bone of the thigh, behind the "stifle joint," or true knee. Its action is evidently to draw back the stifle joint, in other words, to straighten the leg. It has therefore enormous power in impelling the animal forward. The *glutæi* muscles bend the leg preparatory to taking the spring, and the *triceps* acts in opposition, forcing the leg straight, and consequently lifting the body forwards. The posterior margin of this muscle may be more or less distinctly observed, parallel to the outline of the bullock, in all kinds of horses, but is particularly evident in hunters and racers, where high condition has resulted from the proper exercise of these powerful springs of motion. Parallel with, and immediately behind the *triceps* is the *biceps* (Pls. I, XIII, XIV, *o*). It springs from the sacrum and the first bones of the tail, and descending to the inner side of the lower bone of the thigh (*tibia*) forms the outer posterior border of the haunch, and assists in straightening the leg. The *semi-membranosus* (Pls. I, XIV, *p*), is also one of the flexors of the leg; it forms the inner posterior border of the haunch, and unites on the mesial line, under the tail, with its fellow muscle of the other quarter.

On the outer front part of the haunch is the *musculus*

fasciæ latæ (Pls. I, XIII, *q*). It arises from the anterior portion of the crest of the ilium and is enclosed between two layers of tendinous substance which disappears below the stifle. This peculiar muscle binds down and secures the other muscles in front of the haunch. The *rectus* (Pl. XIII, *r*) proceeds from the ilium in front of the hip joint, and is inserted into the patella or knee-cap. It forms the front edge of the thigh. Behind the rectus, and also inserted into the patella, is a large muscle called the *vastus externus*, (Pl. XIII, *s*) of which a part only can be seen externally. These muscles are powerful extensors of the thigh.

Descending inside the thigh is a narrow strip of muscle terminating just below the stifle joint. This is the *sartorius* or "tailor's muscles;" it bends the leg *(tibia)* and turns it inwards. It can hardly be seen. By the side of this muscle, and to the rear of it, occupying the principal surface of the inside of the thigh (*femur*), we find the *gracilis* (Pls. I, XIII, *u*) inserted, like the sartorius, into the upper part of the lower bone of the thigh (*tibia*). Of the muscles which move the lower portion of the leg and the foot, the *extensor pedis* (Pls. I, XIII, *v*) is the most important. It arises behind the stifle, from the extremities of the two bones of the thigh (*femur et tibia)* and descending to the hock, where its tendon passes under a sheath confining it to its place in front of that joint, continues its course to the foot and is inserted by a wide expansion into the

front of the coffin bone. The *peronæus* (Pls. I, XIII, *w*) follows much the same course as the last muscle, but takes a more lateral direction. It arises from the fibula, and the tendon passes on the outside of the hock, after which it descends to the foot with the tendon of the *extensor pedis*. These muscles lift the foot forwards. Between these muscles there is a small narrow one having the same function as the others, and whose tendon is visible just above the hock. The *flexor pedis* (Pls. I, XIII, XIV, *x*) is one of the principal muscles for bending the foot. It arises from the upper part of the tibia, and becoming tendinous before it reaches the hock, passes as a large round cord through a groove at the back of that joint; it then descends behind the shank bone to be inserted into the two pasterns. At the back of the "thigh" (*tibia*) the extremities of the *gastrocnemii* may be seen (Pls. I, XIII, XIV, *y*) with united tendons (*tendo achilles*) passing to the "point of the hock" (*os calcis*), where they are strongly inserted. There is some little difference between the development of the muscles whose tendons lead to the heel in man and the horse. In man, the artist will remember the *soleus* as forming the principal element in the great tendon of the heel. The *gastrocnemii* also contribute towards it. In the horse, however, these latter muscles take a more important share, and are aided by the *plantaris* which, in man, is extremely small. The *soleus*, on the other hand, is as little developed in the horse.

We may notice one muscle on the inside of the

"thigh" (*tibia*). In Pls. I, XIII, XIV, *z*, is the *flexor metatarsi* or bender of the "leg." It originates above the "stifle," on the upper bone of the thigh (*femur*), and is inserted into the shank and inner splint-bone. It lies just within the anterior margin of this "thigh" (*tibia*), and acts with considerable power in bending the hock, thereby raising the metatarsal bones. The metatarsus (Pl. XII, *j*) is entirely without muscular covering, its shape being solely due to the form of its component bones, and the position of the tendons and ligaments which pass over it in their descent to the pastern and foot.

THE END.

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